

streambed level by only a few inches. If a coherent sediment wave was allowed to occur, however, some damage may result at the existing county bridge located about ½-mile downstream from Coleman Diversion Dam. Sediment deposition at the bridge could raise the local river stage by 3 to 5 feet.

To prevent the possibility of a slug of sediment moving downstream, it is suggested that before Coleman Dam is removed a channel be excavated upstream through the sediment. Mechanical channelization can help the stream return to its pre-dam condition more quickly and with less adverse environmental consequences than through natural erosion alone [11]. Creating such a channel within the deposited sediment would also benefit fish passage. Without such a channel, there could be a barrier to fish passage after the dam is removed. The excavated channel should extend about 500 feet upstream from the damsite, ranging in depth from 10 feet at the dam to daylight at the upstream end, for a channel bed slope of 0.02. The bottom width should be at least 30 feet, and the side slopes should be about 2.0H:1.0V, or equal to the angle of repose of the sediments. Much of the sediment can be distributed along the banks of the channel. For cost estimating purposes, an estimated 5,000 yd<sup>3</sup> is assumed to be removed from the channel and hauled to a land disposal site within 1 mile. The excavated channel would be intended only to help start the erosion process, and would not be considered a stable channel. The river would be expected to further alter the channel geometry to suit itself.

#### 4. Conclusions

Erosion of the sediment behind the dams by natural river flows should produce satisfactory results. Significant quantities of fine materials are not present behind the dams and therefore the adverse environmental problems associated with such sediments will not occur. In addition, no problems with deposition downstream of the dam should exist since the hydraulic conditions do not change significantly and the volume of sediment trapped behind these dams is relatively small. It is recommended, however, that a channel through the sediment behind Coleman Dam be created artificially, by mechanical methods, if not quickly established naturally. This will provide easier fish passage and prevent the possibility of the formation of a sediment wave which could affect a county bridge downstream.

#### H. Other Environmental Considerations

Preliminary information on other potential environmental considerations associated with dam removal is provided below. Additional information on these topics will be developed by others in order to fully meet applicable federal, state, and local regulations.

##### 1. Noise Abatement

Noise would be produced by various dam removal activities including the operation of heavy construction equipment, including an excavator with hoe-ram and possibly a dozer; hauling equipment, including trucks and helicopters; drills and jackhammers; air compressors; and possibly occasional controlled blasting at the Coleman damsite. Noise levels may produce short-term, minor adverse impacts close to the damsites, and along the helicopter flight paths, but should not

be noticeable beyond about 1 mile. Natural attenuation of noise levels would be provided by trees and the existing terrain. No special noise abatement procedures should be necessary.

## 2. Air Quality

Construction activities during dam removal would send minor amounts of traffic-related pollutants and some particulates into the air in the immediate areas. Construction-related sources of particulates would include the use of unimproved haul roads, loading and dumping, hoe-ramping, and possibly blasting. Dust generated by construction traffic, and possibly by helicopter operations, may require some mitigation by occasionally spraying water for dust abatement.

## 3. Water Quality

The dam removal process would be expected to increase stream turbidity levels to some degree for short periods of time due to any operations within the channels. Potential adverse impacts are expected to be minor. Significant quantities of fine-grained (silt or clay) materials are not expected to be encountered in either the downstream channels or the upstream reservoirs, due to the relatively high flow velocities in the streams, and the relatively short detention times in the small reservoirs. Some investigations will be required to confirm this assessment for final design. No significant long-term impacts to water quality (such as temperature, dissolved oxygen, or turbidity) or flood control are expected, due to the very small storage capacity of the reservoirs. The total surface area of all three reservoirs is less than two acres. Necessary permit applications would be made to the U.S. Army Corps of Engineers for a Section 404 permit (dredge and fill), and to the California state certifying agency for a Section 401 (water quality) certificate for each construction site. Suitable precautions will be taken to prevent any hazardous material spills (diesel fuel, oil, gasoline) from construction equipment working in the stream channels. The cost estimates prepared for this study include no special mitigation for any potential water quality concerns. Construction is primarily assumed to occur during a time of year for which minimum impacts to anadromous fish would be expected (July and August), although some construction activities may be required through the late summer and fall.

## 4. Public Health and Safety

Applicable construction safety standards will be enforced during all dam removal activities. Any structures remaining at the sites will be modified as required to ensure public safety, and appropriate warning signs will be posted. It is expected that the Coleman damsite will remain inaccessible to the public, due to its location on PG&E property. The Eagle Canyon damsite is located on private property, and the Wildcat damsite may be sold by PG&E to private interests if it becomes no longer necessary for the operation and maintenance of hydropower facilities.

## 5. Traffic

Local construction traffic is expected to be minor, and generally limited to Manton Road, Battle Creek Bottom Road, and Wildcat Road. No special traffic

control measures should be required. Helicopter flights would probably originate from the local airport located in Redding.

## 6. Species of Special Concern

The valley elderberry longhorn beetle was listed as a threatened species by the U.S. Fish and Wildlife Service in August 1980, providing the species with protection under the federal Endangered Species Act. The valley elderberry longhorn beetle completes its entire life cycle within or upon mature elderberry bushes, having at least one stem greater than one inch in diameter at ground level.

One such elderberry bush (with four mature stems) is located within the project area at Eagle Canyon Dam, which will require the development and approval of an elderberry avoidance and mitigation plan prior to dam removal [2].

Some state and federally listed plants and other threatened or endangered species may occur in the project areas [2]. Further investigations will be required at all three damsites for final design.

## 7. Cultural Resources

Removal of the diversion dams would mean the loss of historic structures eligible for listing on the national register. Mitigation would be provided by the preparation of an Historic American Engineering Record (HAER) for each damsite. Although cost estimates for full removal have been prepared, portions of each dam could remain to aid in interpretation of the historic sites, in addition to reducing dam removal costs. Potential candidates for retention include the canal intake structure at Wildcat Diversion Dam, the canal wall and gate winch block at Eagle Canyon Dam, and the concrete steppool fish ladder and masonry gravity weir structure at Coleman Diversion Dam.

A cultural resources survey was prepared by Robert I. Orlins, DWR Associate State Archaeologist, for the Eagle Canyon damsite in January 1998, consisting of a record search and a field reconnaissance [2]. No historic sites have been recorded in the vicinity of Eagle Canyon Diversion Dam, and no cultural resources were identified during the survey within the project boundaries, other than the dam itself. Further investigations will be required for all three damsites for final design.

## 8. Socioeconomics

Dam removal would result in the loss of hydroelectric power associated with reduced streamflow diversions. Current diversion capacities for hydropower generation are 70 ft<sup>3</sup>/s from Eagle Canyon Diversion Dam, about 80 ft<sup>3</sup>/s from Coleman Diversion Dam (without Inskip Powerhouse releases), and a potential for 18 ft<sup>3</sup>/s from Wildcat Diversion Dam. Cost estimates for foregone hydropower generation are being developed by Resources Management International (RMI).

Minor economic impacts may result from dam removal, due to the employment of construction workers performing the demolition work in the short-term, and due to reduced maintenance requirements for PG&E over the long-term. A major

socioeconomic benefit would be the long-term restoration of anadromous fish in Battle Creek (the project purpose).

## I. Project Schedule and Estimated Costs

### 1. Development of Construction Logic and Durations

A preliminary bar chart indicating principal construction activities, estimated durations, proposed sequence, and associated schedules for partial dam removal is provided in Appendix C. The schedules assume initial work in the stream channel begins on July 1 at Wildcat Dam, and proceeds through August at Eagle Canyon Dam, until completion at Coleman Dam in mid-September. Removal of all features at the dams would increase the estimated durations shown. Pipeline and flume removal activities are assumed to be essentially independent of the dam removal (stream channel) work, with the lone requirement that removal of the Eagle Canyon Canal flume cannot commence until after Wildcat Dam has been removed, due to streamflow diversion requirements. It is assumed that a single helicopter would perform both the Wildcat Canal pipeline and the Eagle Canyon Canal flume removal activities. A larger helicopter, or Skycrane, would be used for equipment mobilization to both canyon sites.

Preconstruction activities include the collection of design data, the preparation of final designs and specifications, and issuance of the specifications package for the dam removal project, which is estimated to take approximately 9 months. The bidding process is assumed to take 4 to 6 weeks, at which time the bids would be opened. Concurrent environmental protection and permitting activities may require 2 to 3 months to get agreement and approvals on the action to take, 3 months to prepare an Environmental Assessment (EA) and receive the expected Finding of No Significant Impact (FONSI), and between 1 and 3 months to get the necessary 404 and 401 permits required for construction to begin.

Administrative activities include an estimated 30 calendar days for contract award and notice to proceed following the bid opening. It is assumed that construction access and demolition plans will be required to be submitted, for approval, by the contractor, which may require 30 calendar days to prepare and 20 calendar days to approve. These activities need to be completed in time to permit site mobilization by about June 24.

Dam removal activities at Wildcat Dam would begin with site mobilization and reservoir drawdown to approximately elevation 1073.2, or the lowest level possible, which requires the disconnection of the Wildcat pipeline at the dam, and operation of the canal intake and sluice gates full open to pass streamflow. A Cat 311 excavator, or equivalent, would be delivered to the canyon site using a large helicopter, or Skycrane, to facilitate streamflow diversion and begin demolition of the masonry dam. Demolition of the dam section using a hoe-ram attachment on the excavator, and final spreading of the masonry rubble using a bucket attachment, would require 7 to 10 working days, based on an average production rate of about 1 cubic yard per hour. Demolition of the fish ladder structure, and removal of the waste concrete and mechanical items from the site, would require an additional 3 to 5 working days. This translates to 3 weeks for river channel